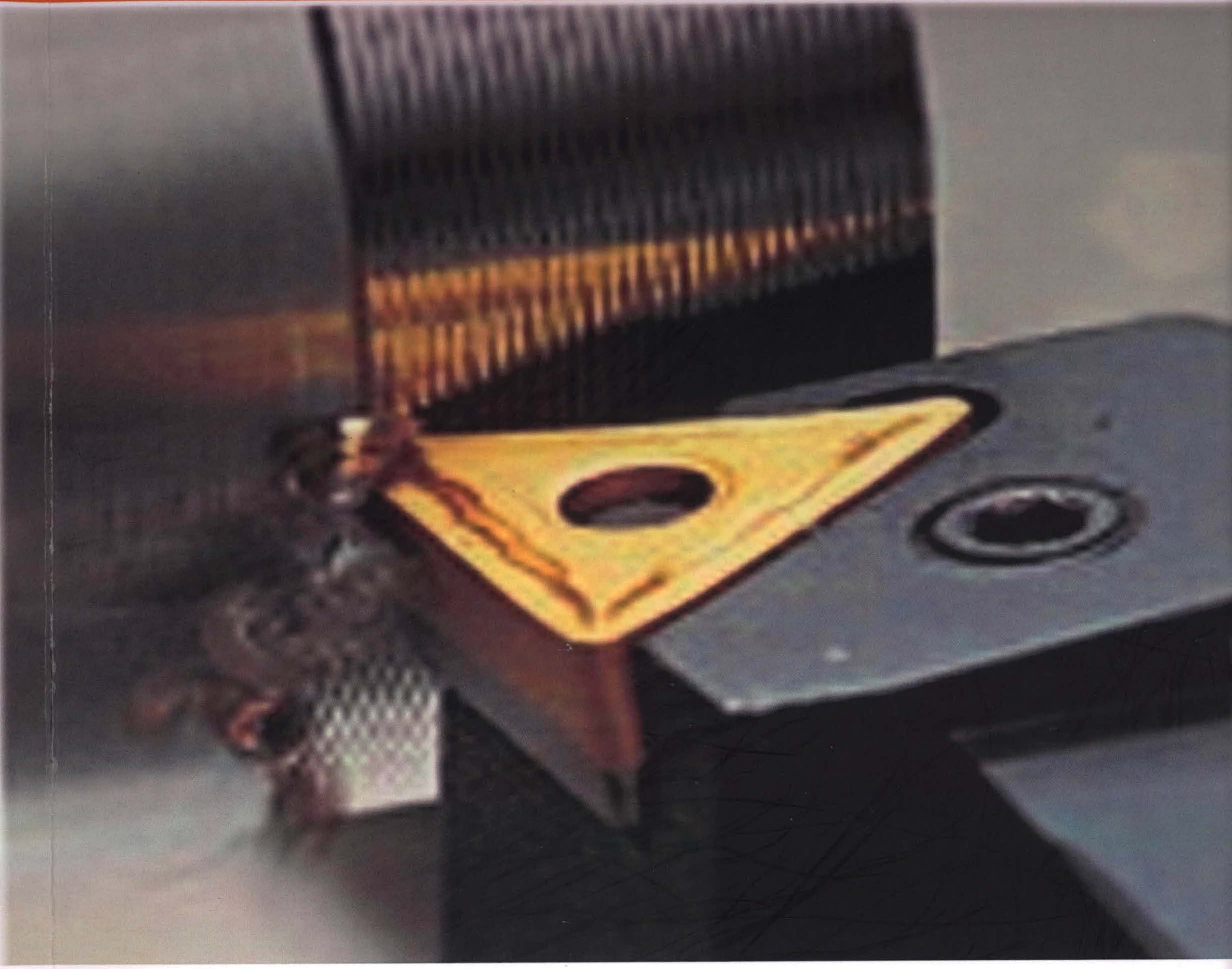

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HIGH SPEED CUTTING

An Approach towards Improved Machining Performance

Manufacturing and Materials Department

Kulliyyah of Engineering

International Islamic University Malaysia

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An Approach towards Improved Machining Performance

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Chapter One

New Tool Life Models in Turning Hardened Steel AISI 4340 under High Cutting Speed

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1.1 Introduction

The famous formula and its extensions for estimating and predicting the tool life has been established around one hundred years ago (1907) by Taylor and still used until now.

In 1977 the International Standard Organization introduced the standard ISO 3865 to unify tool life testing procedures. The standard defines tool life as the time elapsed until a defined amount of wear has occurred in the rake face or flank face of the cutting tool. More ISO standards followed to cover tool life testing procedures in face milling (ISO 8688-1, 1989) and end milling (ISO 8688-2,1989) in addition to the revised version of ISO 3865 appeared in 1993. The purpose of these standards is to unify testing procedures in order to increase the reliability and the unity of test results when making comparisons of cutting tools, work materials, cutting parameters or cutting fluids.

Mehrban et al., (2007) claimed that Taylor equations consume a lot of time and money. Jawahir et al., (2003) said that it requires vast amounts of data and long experimental testing. Thus, establishing new models are utmost important.

Many researchers developed mathematical models for predicting the flank wear then the tool life for different cutting tools (Usui et al. 1984: Huang and Liang, 2004: Adesta et al., 2009: Singh & Rao, 2010)

In high speed cutting for hard materials, the cutting area is under high temperature, high pressure, and high sliding velocity. Therefore, the cutting tool under this condition has normally complex wear behaviors. Mamalis et al., (2002) claimed that with the change of cutting conditions, the tool's mechanical and thermal load changes, and the ratio of the wear components modifies. Therefore, it is difficult to handle mathematically.